

relating to recycle of an ink cartridge capable of ink to printing means of an ink jet recording apparatus.

(0002)

(Prior Art)

A device for ejecting ink in this kind of the conventional ink cartridge, which is disclosed in Japanese Patent Laid Open No. Hei 7-232438 (known example), has been known.

(0003)

Summary of this known example is as follows: An ink jet cartridge C includes a memory 1 having a discrimination signal ID; On a main body of a device P side, there is provided a controlling section 2 having CPU, a timer 3, a memory or the like; the discrimination signal ID is read in this controlling section 2; the time elapsed of the ink jet cartridge C is calculated from the discrimination signal ID; and an electric pulse which is supplied to a heater 4 provided in the ink jet cartridge corresponding to the calculated time elapsed is controlled thereby to control ink ejection.

(0004)

(Problems to be solved by the Invention)

In said known example, the time elapsed or the like of the ink cartridge C is read out from the memory 1 for ink ejection, and ink can be supplied to the printing means effectively.

(0005)

However, in this known example, the information of the memory 1 is utilized only for the ink ejection.

(0006)

A first problem to be solved by this invention is to

provide a device capable of suitably recycling the ink cartridge by use of the history of use of the ink cartridge which is stored in the memory means disposed in the ink cartridge and by use of another information, and to provide a method for recycling the ink cartridge.

(0007)

A second problem to be solved by this invention is to provide a device capable of recycling the ink cartridge and its method by determining the recycle condition of the ink cartridge according to the use information of the ink cartridge.

(0008)

A third problem to be solved by this invention is to provide a device which reproduces the ink cartridge according to the increase of the recycle number and change of the time elapsed and can always expect printing of high image quality, and to provide its method.

(0009)

(Means for Solving the Problems)

Concrete means correspondingly in order to solve said respective problems are as follows:

(0010)

(1) An ink cartridge reproducing device wherein an ink cartridge includes a memory section for memorizing information of use of the ink cartridge such as information of use history or the like and can supply ink to printing means of an ink jet recording apparatus; and reading of the information of use of the ink cartridge from said memory section in the ink cartridge, judgment of a reproducing method, writing of reproduction

information are made possible.

(0011)

(2) The ink cartridge reproducing device described in said (1), wherein said information of use represents the number of recycles of the ink cartridge.

(0012)

(3) The ink cartridge reproducing device described in said (1), wherein said information of use represents a production date and recycle date of the ink cartridge.

(0013)

(4) A method for reproducing an ink cartridge which is a method for recycling an ink cartridge after use, wherein possibility and impossibility of recycle of the ink cartridge and the reproduction condition are determined by comparing the reproduction information which is necessary for recycle of the ink cartridge and memorized in the memory section of said ink cartridge so that it can be rewritten with set information stored in the ink cartridge reproducing device.

(0014)

(5) The method for reproducing the ink cartridge described in said (4), wherein said reproduction information memorized so that it can be rewritten is the information of use and said set information stored in the ink cartridge reproducing device is the condition capable of recycle.

(0015)

(6) The method for reproducing the ink cartridge described in said (4), wherein said reproduction information capable of being rewritten represents the number of recycles of the ink cartridge and said set information represents the

number capable of recycle.

(0016)

(7) The method for reproducing the ink cartridge described in said (4), wherein said reproduction information capable of being rewritten represents a production date and recycle date of the ink cartridge and said set information presents limit of lifetime.

(0017)

(8) The method for reproducing the ink cartridge described in said (4), wherein said reproduction information capable of being rewritten represents an ink end date of the ink cartridge and said set information represents the number of dates which elapses after the ink end date.

(0018)

(9) The method for reproducing the ink cartridge described in said (4), wherein said reproduction information capable of being rewritten represents using environment information of the ink cartridge and said set information represents a severe environment value.

(0019)

(10) The method for reproducing the ink cartridge described in said (4), wherein said reproduction information represents judgment of whether ink in the ink cartridge after use is extracted or its ink cartridge is cleaned.

(0020)

(11) The method for reproducing the ink cartridge described in said (4), wherein said reproduction information represents a cleaning time period of the ink cartridge after use.

(0021)

(12) The method for reproducing the ink cartridge described in said (4), wherein said reproduction information represents the ink charging amount of the ink cartridge.

(0022)

(13) The method for reproducing the ink cartridge described in said (4), wherein said reproduction information represents member exchanging condition of the ink cartridge.

(0023)

(14) The ink cartridge reproducing device described in said (1), wherein said reproduction information represents the recycle number of the ink cartridge.

(0024)

(15) The ink cartridge reproducing device described in said (1), wherein said reproduction information represents a recycle date of the ink cartridge.

(0025)

(16) The ink cartridge reproducing device described in said (1), wherein said reproduction information represents the cleaning number of the ink cartridge and cleaning condition when the ink cartridge is reproduced.

(0026)

(17) The ink cartridge reproducing device described in said (1), wherein said reproduction information represents the ink charging amount when the ink cartridge is reproduced.

(0027)

(18) The ink cartridge reproducing device described in said (1), wherein said reproduction information represents information of the member exchanged when the member exchange

is required during reproduction of the ink cartridge.

(0028)

According to the above corresponding means, the ink cartridge after use can be reproduced by the suitable recycle condition in accordance with the state of use thereof and a superior printing result can be obtained which approximates to that in case where a new ink cartridge is used.

(0029)

(Embodiment of the Invention)

One embodiment of this invention will be described below referring to drawings. This ink cartridge reproducing device 1000 comprises reproduction evaluating means 100 and reproduction processing means 500, and they and the mutual relation will be described successively.

(0030)

#### 1. means

The ink cartridge reproducing device 1000 according to this embodiment is characterized in that based on information of use history (use information) UI of an ink cartridge IC after use which is recorded in a memory section ME which is composed of a semiconductive chip or the like and mounted in the ink cartridge IC, possibility and impossibility of recycle of the ink cartridge IC or recycle condition or the like is judged. Fig. 1 shows a function block diagram showing a constitution of the ink cartridge reproducing device 1000.

(0031)

#### 11. reproduction evaluating means 100

In the reproducing means 100 having an evaluation table 110 on which the collected ink cartridge IC can be placed, there

is provided a detecting section 120 which can correspond to the memory section ME mounted on the ink cartridge IC. To this detecting section 120, reading means 130 for reading the use information UI from the memory section ME and rewriting means 140 for rewriting the use information UI of the memory section ME are connected; said reading means 130 and the rewriting means 140 are respectively connected to controlling means 160 which is connected to an internal memory 150 which records information (set information) such as standard use limit or the like regarding the ink cartridge IC and which is composed of CPU, and various information (reproduction information) RI regarding reuse of the ink cartridge IC is indicated in display means 170 connected to this controlling means 160.

(0032)

## 12. reproduction processing means 500

In the reproduction processing means 500 actuated according to the reproduction information RI provided from said controlling means 160, there are ink extracting means 520 for completely extracting ink left in the ink cartridge IC after use, cleaning means 540 for cleaning the ink cartridge IC, member exchanging means 530 for exchanging the wasted component member of the ink cartridge IC, ink charging means 550 for recharging new ink, and the like.

(0033)

Said use information UI, set information SI and reproduction information RI will be in detail described together with use process of this reproducing device 100 referring to flowcharts shown in Figs. 2 and 3.

(0034)

## 2. use process

Needless to say, it is indispensably important to recycle the ink cartridge IC after use for effective utilization of resources and preservation of the environment. In its reuse, only by recharging new ink in the ink cartridge in which there is no ink, the printing result of high quality can not be expected.

(0035)

That is, when the ink cartridge IC is reused, the suitable reproduction processing must be carried out in consideration of several conditions which the ink cartridge IC experienced.

(0036)

In this case, as required conditions to be considered, there are at least the following use information UI.

(0037)

(a) the number of recycles:

On the ink cartridge IC, there is an air released hole which is formed by welding a film and communicates the inside of the ink cartridge container with the outside. This air released hole requires the sectional area having a suitable size, taking evaporation of ink into consideration. When the film is welded, the resin of the upper surface of the ink cartridge IC is slightly melted, so that the sectional area of the air released hole is reduced. If recycle is repeated, the sectional area of the air released hole becomes too small to exhibit its natural function, so that it is necessary to limit the number of recycles.

(b) 10 years after reproduction/recycle date:



As the container and the form are affected by ink, it is necessary to determine the lifetime of the ink cartridge IC in consideration with breaks of the container and a capillary force of the form.

(c) 200 days after ink end:

If ink ends and the ink cartridge IC is removed from the printer, the residual ink starts to evaporate from the portion connected to the printer, so that a density of the residual ink increases or the residual ink is stuck. In order not to use such the ink cartridge IC, it is necessary to determine the predetermined day after the ink end.

(d) environment of use 5 to 40°C: Environment information of use of printer

The printer is not used at a temperature over this range of temperature. A temperature sensor is attached in the printer and the maximum value and the minimum value during using the printer is written by the printer in order not to use the ink cartridge IC in which there is left ink of which the component was changed by using the printer over the environment of use.

(e) member exchange:

When the ink cartridge IC and the ink jet recording apparatus are connected to each other, seal rubber or the like for preventing ink leakage, which can be simply exchanged, is exchanged to reproduce the ink cartridge, if the ink cartridge can be reused by exchanging only its member.

(f) cleaning:

In case that a density of the residual ink is high or the number of recycles is large, it is necessary to sometimes

clean the inside of the ink cartridge IC, and the cleaning time period can be changed according to the environment of use of the ink cartridge IC.

(g) ink charging amount:

When the form is so old that the initial efficiency (capillary force) can not be expected, the ink charging amount is reduced.

(0038)

In the memory section ME mounted in the ink cartridge IC, the use information UI separately used when the memory ME was mounted in the ink jet recording apparatus has been already written, so that its use information UI is read by the reading means 130 in the reproduction evaluating means 100.

(0039)

Further, the set information SI for ensuring the image quality, which indicates the limit of use regarding the ink cartridge IC, is recorded in the internal memory section 150.

(0040)

The kinds of this set information are as follows:

(0041)

- (イ) limited number of recycles
- (□) limited period which elapses after recycle date
- (ハ) limited period which elapses after ink end
- (ニ) range of safe environmental temperature of ink cartridge

(ホ) use period of component member

(0042)

Accordingly, by comparing said use information UI (a) to (g) with the set information SI (イ) to (ホ), the reproduction

condition of the ink cartridge IC is judged; the judged condition is indicated as reproduction information RI by the display means 170; the reproduction information is informed of said ink extracting means 520, cleaning means 540, ink charging means 550, or member exchanging means 530 which are provided in a row; and the ink cartridge IC is mounted to each means 520 to 550 thereby to successively perform the recycle operations.

(0043)

Next, the reproduction process of the ink cartridge IC by this reproducing device 1000 will be described based on flowcharts shown in Fig. 2 which shows reproduction evaluating process and in Fig. 3 which shows reproduction processing process.

(0044)

(1) reproduction evaluating process

①As shown in Fig. 2, the ink cartridge IC having the memory section ME in which the use information UI when the ink cartridge is used by a user is recorded is mounted on the evaluation table 110 in the reproduction evaluating means 100, whereby the memory section ME abuts on the detecting section 120 (S1).

(0045)

② The use information UI of the memory section ME is read by the reading means 130 (S2).

(0046)

③ By comparing the use information UI with the set information SI in the internal memory 150, whether the ink cartridge can be recycled or not is evaluated.

As its evaluation process, there are the followings: whether the number of recycles is less than ten times or not (S3), whether the time period after production/recycle date is more than 10 years or not (S4), whether the time period after ink end is more than 200 days or not (S5), and whether the ink cartridge has been used in the use environment of 5 to 40 °C or not (S6). The order of these steps (S3) to (S6) is not always important.

(0047)

④ The possibility and impossibility of recycle is indicated in the display means 170 (S7, S8).

(0048)

⑤ An instruction of recycle processing is given to the reproduction processing means 500 (S9).

(0049)

⑥ The reproduction information RI such as the reproduction condition is informed of the rewriting means 140 and the use information UI of the memory section ME is rewritten (S12).

(0050)

⑦ An instruction of discard is given (S11).

(0051)

(2) reproduction processing process

In reproduction processing process (T1 to T11) described below, said use information UI (a) to (g) is compared with the set information SI (イ) to (ホ) by the controlling means 160, and the required reproduction information RI is visually indicated by the display means 170 and informed of the reproduction processing means 500 from the controlling means

160. This reproduction processing process will be described below referring to Fig. 3.

(0052)

① The ink cartridge IC which has been estimated to be capable of recycle is taken out of from the evaluation table 110 and mounted to the processing section 510 of the reproduction processing means 500 (T1).

(0053)

② The residual ink is removed by the extracting means 520 (T2).

(0054)

③ Whether all the members of the ink cartridge IC are within lifetime or not is judged (T3). In this case, whether the seal rubber is within 5 years after the production date or not, or whether there is fear of ink leak or not is judged.

(0055)

④ The required member is exchanged in the member exchanging means 530 (T4).

(0056)

⑤ Whether the ink cartridge is cleaned or not is judged from the following points: whether the ink cartridge has not been cleaned for 100 days and more since ink end or for 5 years and more since a production date, or whether the ink cartridge has been used in the environment of 30 °C and more (T5).

(0057)

⑥ Regarding the time period necessary for cleaning, for example, if 150 days and more elapse after ink end or ten years and more elapse after a production date, it is necessary to clean the ink cartridge for a fully long time. Here, the

cleaning time period is judged (T6).

(0058)

⑦ Cleaning operation is carried out by the cleaning means 540 (T7, T8).

(0059)

⑧ Ink charging amount is judged. It is desirably that a small amount of ink is charged if five years and more elapse after the production date.

(0060)

⑨ Ink is charged by the ink charging means 550 (T10, T11).

(0061)

The main reproduction processing of the ink cartridge IC is completed by the above steps (T1 to T11). Description of the deserved processing in relation to a finished product, for example, seal attachment, double packing, or the like for preventing ink leakage, is omitted.

(0062)

In this embodiment, the reproduction evaluating means 100 and the reproduction processing means 500 are directly coupled to each other to execute a series of reproduction processing. However, needless to say, the reproduction information RI judged in the reproduction evaluating means 100 may be output from the controlling means 160 composed of CPU and supplied to a reproduction processing device which is separately prepared thereby to perform the reproduction processing.

(0063)

Further, the reproduction information RI judged in the

reproduction evaluating means 100 may be once written in the memory section ME of the IC 110 and read in the reproduction processing means 500 thereby to perform the reproduction processing.

(0064)

(Effect of the Invention)

As described above, characteristic effects produced by the present invention are as follows:

(0065)

① The ink cartridge after use can be reproduced by the suitable reproduction conditions.

(0066)

② The reproduction conditions of the ink cartridge after use can be changed to always reproduce the ink cartridge effectively.

(0067)

③ Printing of high quality similar to that in a new ink cartridge can be obtained.

(BRIEF DESCRIPTION OF THE DRAWINGS)

(Fig. 1)

Fig. 1 is a function block diagram of a reproducing device according to an embodiment of this invention.

(Fig. 2)

Fig. 2 is a flowchart of reproduction evaluating means of Fig. 1.

(Fig. 3)

Fig. 3 is a flowchart of reproduction processing means of Fig. 1.

(Description of Symbols)

1000 ink cartridge reproducing device  
100 reproduction evaluating means  
130 reading means  
140 rewriting means  
150 internal memory  
500 reproduction processing means  
520 ink extracting means  
530 member exchanging means  
540 cleaning means  
550 ink charging means  
UI use information  
RI reproduction information  
SI set information  
ME memory section  
IC ink cartridge